Frequency analysis of ventricular fibrillation and synchronized defibrillation in the dog heart

C. 23

Frequency analysis of ventricular fibrillation and synchronized defibrillation in the dog heart

By A. A. J. Adgey, J. D. Allen, J. Anderson, A. Bailey, E. J. F. Carlisle* and W. G. Kernohan. *Regional Medical Cardiology Centre, The Royal Victoria Hospital, Departments of Physiology and Orthopaedic Surgery, The Queen's University, and Department of Electrical Engineering, University of Ulster, Belfast*

Is ventricular fibrillation (VF) a random arrhythmia? Spectral analysis of electrically induced VF in the non-ischaemic dog heart showed a periodic component in the arrhythmia. The first 40 s of VF (10 dogs) showed a dominant frequency of $11{\cdot}5 \pm 0{\cdot}6$ Hz (mean ± s.e. of mean), with -10 dB limits of $8{\cdot}4 \pm 0{\cdot}6$ Hz (lower) and $13{\cdot}0 \pm 0{\cdot}6$ Hz (upper).

Defibrillation of the heart occurs when a critical mass of myocardium is depolarized, usually by electrical means. Does the phasic component of VF have any significance for defibrillation? If so, the minimum energy required for defibrillation may be different for shocks synchronized to either the peaks or the troughs of the VF waveform. Lowering the energy required for defibrillation would minimize the chance of myocardial damage due to the countershocks themselves.

Anaesthetized dogs (pentobarbitone 30 mg/kg i.v.), were respired with room air. Arterial blood pressure, pH and ECG were monitored. VF was induced electrically via a pacing wire in the right ventricle. A custom-built synchronization circuit sensed the peaks of the VF waveform. After a preset delay it triggered the defibrillator discharge at either the following trough or the next peak of the VF waveform.

The ventricular defibrillation threshold was determined as the smallest transthoracic shock to defibrillate the heart under three conditions, in random order, with transthoracic shocks delivered to the peaks of VF, to the troughs of VF or for unsynchronized shocks. There was no significant difference in the threshold delivered current or threshold delivered energy for shocks synchronized to the peaks of VF, to the troughs or for unsynchronized shocks.

This study supports the previous reports of some periodicity in the VF waveform. However, there appears to be no advantage in using synchronized transthoracic countershocks in the correction of ventricular fibrillation.

* D.H.S.S. (N.I.) Research Fellow.